CLAIMS

1. A valve integrally associated with a microfluidic liquid transport assembly, comprising:

a first rigid layer having substantially planar and opposing first and second surfaces;

a second rigid layer having substantially planar and opposing third and fourth surfaces, the third surface of the second rigid layer being substantially coplanar and integrally bonded to the second surface of the first rigid layer;

a first passageway defined by a groove, the groove being along the second surface of the first rigid layer and bounded by the third surface of the second rigid layer, the first passageway being adapted to flow a liquid sample therethrough,

a valve seat having a substantially planar plateau surface, the valve seat being within the first passageway and integrally connected to the first rigid layer such that the plateau surface is substantially planar to and interposed between the first and second surfaces of the first rigid layer; and

a flexible membrane opposite the valve seat and integrally associated with a first membrane through hole of the second rigid layer, the flexible membrane having a passageway surface that is either (i) substantially coplanar to the second surface of the first rigid layer when the valve is in an open position, or (ii) bulged with a central portion thereof being substantially coplanar to the plateau surface of the valve seat when the valve is in a closed position.

2. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the microfluidic transport assembly is adapted to flow the liquid sample in a biosensor.

3. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the first and second rigid layers are each made from one or more plastic materials.

4. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the first and second rigid layers are each made of the same plastic material.

5. The valve integrally associated with the microfluidic transport assembly of claim 4 wherein the plastic material is a polycarbonate.

6. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the first and second rigid layers are integrally bonded together by a laser weld.

7. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the first and second rigid layers have a combined thickness ranging from about 1 to about 2 millimeters.

8. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the groove is defined by two opposing sidewalls and a floor.

9. The valve integrally associated with the microfluidic transport assembly of claim 8 wherein the valve seat protrudes from the floor of the groove.

10. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the flexible membrane is a silicone rubber.

11. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the flexible membrane is a thermoplastic elastomer.

12. The valve integrally associated with the microfluidic transport assembly of claim 1 wherein the second rigid layer includes a plurality of first through holes that communicate with the first passageway.

13. The valve integrally associated with the microfluidic transport assembly of claim 1, further comprising a third rigid layer having substantially planar and opposing fifth and sixth surfaces, the fifth surface having a plurality of ridges protruding therefrom, the plurality of ridges defining a second passageway adapted to flow the liquid sample therethrough and a top first ridge surface, the top first ridge surface being substantially coplanar and integrally bonded to the fourth surface of the second rigid layer.

14. The valve integrally associated with the microfluidic transport assembly of claim 13 wherein the third rigid layer includes a plurality of second through holes that communicate with the first and second passageways.

15. The valve integrally associated with the microfluidic transport assembly of claim 14 wherein the third rigid layer includes a second membrane through hole that communicates with the first membrane through hole of the second rigid layer, the at least one second membrane through hole having an additional amount of the flexible membrane, the additional amount of the flexible membrane being coextensively disposed about the walls of the one or more second through holes.

16. The valve integrally associated with the microfluidic transport assembly of claim 13, further comprising a fourth rigid layer having substantially planar and opposing seventh and eighth surfaces, the seventh surface having a plurality of second ridges protruding therefrom, the plurality of second ridges defining a third passageway adapted to flow the liquid sample therethrough and a top second ridge surface, the top second ridge surface being substantially coplanar and integrally bonded to the sixth surface of the third rigid layer.

17. The valve integrally associated with the microfluidic transport assembly of claim 15 wherein the fourth rigid layer includes a plurality of third through holes that communicate with the first, second and third passageways.

18. A method for manufacturing a valve integrally associated with a microfluidic transport assembly, the method comprising the steps of:

integrally bonding a first rigid layer having substantially planar and opposing first and second surfaces to a second rigid layer having substantially planar and opposing third and fourth surfaces, such that the third surface of the second rigid layer contacts the second surface of the first rigid layer, and such that a first passageway is formed wherein the first passageway is defined by a groove that runs along the second surface of the first rigid layer and is bounded by the third surface of the second rigid layer, and wherein the first passageway is adapted to flow a liquid sample therethrough, and wherein the first passageway includes a valve seat that has a substantially planar plateau surface wherein the valve seat is integrally connected to the first rigid layer such that the plateau surface is substantially planar to and interposed between the first and second surfaces of the first rigid layer; and

casting a flexible membrane into a first membrane through hole of the second rigid layer such that the flexible membrane has a passageway surface that is adapted to be either (i) substantially coplanar to the second surface of the first rigid layer when the valve is in an open position, or (ii) bulged with a central portion thereof being substantially coplanar to the plateau surface of the valve seat when the valve is in a closed position.

19. The method of claim 18 wherein the step of integrally bonding involves laser welding the third surface of the second rigid layer to the second surface of the first rigid layer.

20. A valve integrally associated with a microfluidic liquid transport assembly, comprising:

a first means for defining substantially planar and opposing first and second surfaces;

a second means for defining substantially planar and opposing third and fourth surfaces, the third surface of the second means being substantially coplanar and integrally bonded to the second surface of the first means;

a passageway means for flowing a liquid sample, the passageway means being along the second surface of the first means and bounded by the third surface of the second means,

a valve seat means for defining a substantially planar plateau surface, the valve seat means being within the passageway means and integrally connected to the first means such that the plateau surface is substantially planar to and interposed between the first and second surfaces of the first means; and

a flexible membrane means for controllably flowing the liquid sample, the flexible membrane means being opposite the valve seat means and integrally associated with a first membrane through hole of the second means, the flexible membrane means having a passageway surface that is either (i) substantially coplanar to the second surface of the first means when the valve is in an open position, or (ii) bulged with a central portion thereof being substantially coplanar to the plateau surface of the valve seat means when the valve is in a closed position.

21. The valve integrally associated with the microfluidic transport assembly of claim 20 wherein the microfluidic transport assembly is adapted to flow the liquid sample in a biosensor.